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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,082	06/22/2001	Kenneth J. Hines	10488/14:1 USA	6550

7590 05/19/2005

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EXAMINER

KANG, INSUN

ART UNIT PAPER NUMBER

2193

DATE MAILED: 05/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/888,082

Applicant(s)

HINES, KENNETH J.

Examiner

Insun Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-24 and 26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-24 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 December 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

1. This action is in response to the amendment filed 12/13/2004.
2. As per applicant's request, claims 21-24 have been amended and claim 26 has been added. Claims 21-24 and 26 are pending in the application.

Information Disclosure Statement

3. The applicant has submitted a large number of IDS. The IDS has not been considered. An explanation of the relevance for each reference needs to be provided for consideration.

Drawings

4. The objection to the drawings has been withdrawn due to the amendment to the drawings.

Specification

5. The new corrected abstract on a separate sheet is required upon response to this office action.

Claim Rejections - 35 USC § 101

6. The rejection to claims 21-24 has been withdrawn due to the amendment to the claims.

Claim Rejections - 35 USC § 102

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7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 21, 22, and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Reps (US Pub. 2002/0078431).

Per claim 21:

Reps discloses:

- converting a control graph representation of a software system, having a state space and an initial state, into a binary decision diagram of the software system, the control graph and the binary decision diagram to reside at least partially in memory of a computer("An OBDD is based on the representation of a Boolean function as an ordered binary decision tree...An OBDD is a folded version of the binary decision tree in which substructures are shared as much as possible, which turns the tree into a directed acyclic graph (DAG)," page 1 paragraphs 0013-0014; "when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056)

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- transforming the control graph to express a potential next state of the software system, the transforming performed by the computer (“when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree,” page 3 paragraph 0056)
- generating a binary decision diagram based on the transformed control graph, whereby static error checking may be used to further identify unexpected behavior of the software system without fully elaborating the state space of the software system (“An OBDD is based on the representation of a Boolean function as an ordered binary decision tree... An OBDD is a folded version of the binary decision tree in which substructures are shared as much as possible, which turns the tree into a directed acyclic graph (DAG),” page 1 paragraphs 0013-0014; “when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree,” page 3 paragraph 0056; BDDs have been ... applied ... analysis, synthesis, optimization, timing analysis... and verification of software systems,” page 3 paragraph 0040) as claimed.

Per claim 22:

The rejection of claim 21 is incorporated, and further, Reps teaches:

transforming the control graph comprises temporally unrolling the control graph (“when unfolding a decision tree into a CFOBDD, and when unfolding a

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CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056)
as claimed.

Per claim 26, this claim is another version of the claimed method discussed in claim 21, wherein all claim limitations also have been addressed and/or covered in cited areas as set forth the above.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reps (US Pub. 2002/0078431) as applied to claims 21 and 22 above, and further in view of Bryant ("Symbolic Boolean Manipulation with Ordered Binary-Decision Diagrams," ACM, 9/1992).

Per claim 23:

The rejection of claim 22 is incorporated, further, Reps does not explicitly teach an apply algorithm. However, Bryant teaches the apply operation was known in the art of software development and debugging, at the time applicant's invention was made, to generate "Boolean functions by applying algebraic operations to

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other functions (page 301, 3.1 The APPLY Operation). It would have been obvious for one having ordinary skill in the art of computer software development and debugging to modify Reps' disclosed system to use the apply operation to construct the BDD representation. The modification would be obvious because one having ordinary skill in the art would be motivated to "improve the efficiency of the computation and to assist in producing a maximally reduced graph" as the "APPLY algorithm operates by traversing the argument graphs depth first while maintaining two hash tables" as suggested by Bryant (page 301, 3.1 The APPLY Operation).

Per claim 24:

The rejection of claim 23 is incorporated, further, Reps discloses:

- creating a copy of each disjunctive node, each disjunctive node represents a boolean guard on a functional object within one of the software elements ("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) ; creating a copy of each conjunctive node, each conjunctive node represents a conjunctive boolean guard on state changes within the software system("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) ; creating a copy of each action node, each action node represents a functional object within one of the software elements that is responsive to a control interaction and capable of producing a control interaction, if the functional object the action node represents performs a predetermined

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function without a predetermined delay ("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) for each delayed action node which represents a functional object within one of the software elements that has a predetermined delay in responding to or producing a control interaction, creating a sensing edge to connect the delayed action node to a corresponding node in the control graph representing the initial state of the system and creating an outgoing edge to connect the corresponding node, in the control graph representing the initial state of the system, to a corresponding next node, which represent the potential next state of the system; (page 15 paragraphs 0319-323) for outgoing edge, that is also an event edge, connecting the outgoing edge to a create event disjunctive node, which represents an event generated by the corresponding node in the control graph representing the initial state of the system (page 16 paragraphs 0327-0329); for each created event disjunctive node, creating an edge from the created event disjunctive node to an event conjunctive node; for each event conjunctive node, creating an edge from the node that generated the event to the event conjunctive node, and creating an edge from the event conjunctive node to the copy of the node that generated the event (page 18 paragraphs 03"each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) as claimed.

Response to Amendment

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11. The new abstract has not been submitted on a separate sheet. Any new or replacement abstract must be submitted on a separate sheet (37 CFR 1.72).

The new corrected abstract is required upon response to this office action.

Response to Arguments

12. Applicant's arguments filed 12/13/2004 have been fully considered but they are not persuasive.

Per claim 21:

In response to applicant's argument that the reference fails to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., temporally unrolling a control graph to express a potential next state of a software system) are not recited in the rejected claim. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). As such, the claims are read with the broadest reasonable interpretation in mind (Note MPEP 2111).

The applicant also states that the "portion of Reps says nothing about expressing a potential next state of the software system."

In response, the applicant appears to map exact words to words in comparing the limitations in the instant claim 21 and the cited phrases of the Reps reference instead of considering the applied reference as a whole. Further, the limitation, "transforming the control graph to express a potential next state,"

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recited in claim 21 is the general concept of binary decision diagrams that is applied in Reps' reference. Reps states that "BDDs are DAGs and folding a DAG leads to cyclic graph—and hence an infinite number of paths (0072)" and a "CFLOBDD can be used to evaluate a Boolean function by following a path from the entry vertex of the highest-level grouping...making "decisions" for the next variable in sequence each time the entry vertex of a level-0 grouping is encountered (0085)." Thus, all the Binary Decision Diagram aspects described in Reps do fulfill the features brought out in applicant's claim. If applicant means anything more, this must be brought out in the claims to further clarify the invention.

Per claim 26:

The applicant states that Reps does not disclose the limitations of claim 26, for the reasons set forth in connection with claim 21. As shown above, the rejection of claim 21 by Reps was considered proper and maintained, and accordingly, the rejection of claim 26 is also considered proper.

Per claims 23-24:

The applicant states, even if Reps and Bryant were to be combined, the combination would not render claims 23 and 24 unpatentable.

In response, the Applicant fails to show that the reasons to combine and motivations concerning the rejections of the claims are improper discuss the references applied against the claims, specifically explaining how the claims avoid the references or distinguish from them and to point out disagreements

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with the examiner's contentions. Accordingly, all the Binary decision diagram aspects described in Reps are considered to fulfill the features brought out in applicant's claims, given that the apply operation aspect of Bryant is combined into them, for which the motivation is as given above. If applicant means anything more, this must be brought out in the claims to further clarify the invention.

Per claims 22-24:

The applicant states that claims 22-24 are allowable as being dependent on the allowable base claim 21. As has been shown above, the rejection of the independent claim 21 by Reps is considered proper, the argument that claims 22-24 are allowable as being dependent on the allowable base claim is considered moot. Accordingly, the rejections of claims 22-24 are proper and maintained.

Conclusion

13. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

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the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Insun Kang whose telephone number is 571-272-3724. The examiner can normally be reached on M-F 7:30-4 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on 571-272-3719. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

I. Kang
Examiner
5/13/2005



ANIL KHATRI
PRIMARY EXAMINER